

REMARKS

Claims 1-5, 7-15, 17-20 and 22 are pending. Claims 6 and 21 are canceled. Claims 1, 7, 11, 13, 15 and 22 are amended, with support for the amendments found in paragraphs 36 and 37 of the as filed specification. No new matter is added. Claims 1-5, 7-15, 17-20 and 22 stand rejected.

Regarding the Rejections under 35 U.S.C. §103

Claims 1-5, 7-15, 17-20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chow et al (US 6,292,589, hereinafter “Chow”) in view of Whitted et al, “A software Testbed for the Development of 3D Raster Graphics Systems” (January 1982, ACM Transactions on Graphics, New York, NY, USA Volume 1, Issue 1, Pages 43-58, hereafter “Whitted”) in further view of Fuchs et al, “Pixel Planes 5: A Heterogeneous Multiprocessor Graphics System Using Processor-Enhanced Memories”, ACM, Computer Graphics, Volume 23, no. 3, July 1989, pages 79-88 (hereinafter “Fuchs”). These rejections are respectfully traversed.

Regarding claims 1, 7, 11, 13, 15 and 22, claims 1 and 22 each recite at least “associating a pre-determined group of pixels in each block of pixels with the active shader module” and “processing each of the associated groups of pixels in each block of pixels, in parallel, within the active shader module prior to changing active status to another shader module. Similarly, claims 7, 11, and 13 recite at least “separating an image into blocks of pixels, and associating a pre-determined group of pixels in each block of pixels with an active shader module” and “processing each associated pixel in every block within the active shader module prior to changing active status to another shader module,” and claim 15 recites at least “adapting a processing unit to receive blocks of pixels into which an image has been separated, associating a pre-determined group of pixels in each block of pixels with an active shader module, and processing each block of pixels, in parallel, within the active shader module prior to changing active status to another shader module.” The Office Action admits that the Chow et al reference does not teach calculation or pixel manipulation within a shader module and looks to the Whitted and Fuchs references to remedy this deficiency.

The Office Action appears to assert that the Fuchs reference discloses the above-recited features of the independent claims at the abstract and at page 81, Section 4, however, it does not. The disclosure in the abstract of Fuchs provides a description of a hardware-based rendering machine with a software calculator to perform the rendering calculations on groups of pixels in which every pixel within a group of pixels of pre-determined size (128 x 128 in the example provided) is fully processed by a shader prior to releasing that shader to perform calculations on a subsequent group of pixels. In addition, Fuchs discloses, in figure 1 that a plurality of Renderers are active, each with their own shader process, such that each block of pixels is processed separately by an individual Renderer until all blocks of pixels have been individually processed. On page 81, the Fuchs reference further discloses that “[o]nce transformed, sorted, and stored, a new scene is rendered by assigning all available Renderers to patches on the screen and dispatching to these Renderers primitives from their corresponding bins...The Renderer is then assigned to the next patch to be processed.” There is no disclosure of all pre-associated pixels within each block of pixels being processed by a single shader process, whereafter a next shader process is then loaded. In claims 1, 7, 11, 13, 15, and 22, the expensive process of swapping out shader processes in active memory is minimized by processing all of the pixels within each block assigned to the active shader in parallel prior to changing the active status to a newly loaded shader process. As a non-limiting example, if an image were to be divided into 8x8 blocks and the first 8 pixels in column 0 of each block are all associated with shader 0, every pixel in each column 0 in every block in the image would be processed by shader 0, in parallel, prior to relinquishing control. When shader 0 is replaced by shader 1, all pixels associated with shader 1 for every block in the image would be processed by shader 1 in parallel. In an image in which 8 shaders are defined, this would require only 8 changes of the shader process to complete the pixel processing for all blocks of pixels within the entire image. Fuchs simply does not disclose or teach this optimization of processing.

In addition, a Renderer and a shader module are related graphics functions, however, a renderer and a shader module are employed for different functions. A rendering function is applied to calculate the effect of light sources on color and intensity of pixels within a graphics frame. A shader module calculates the 3-D surface properties of objects in terms of effects, colors, textures and shapes to generate complex, realistic scenes, and may perform

this function singly, without accessing a separate rendering function. However, even if a renderer could be equated to a shader, the Fuchs reference still does not provide the disclosure to minimize the use of renderer, or shader, processing by processing pixels in each block of pixels in parallel by a single shader process. Thus, the Fuchs reference does not remedy the lack of disclosure in the Chow reference as recited in independent claims 1, 7, 11, 13, 15 and 22.

The Whitted reference also does not remedy the lack of disclosure in the Chow reference, because the Whitted reference is completely silent with regard to processing specific pixels in each block of pixels in parallel by a single shader process.

Thus, the combination of the Chow, Fuchs and Whitted references does not teach or suggest the foregoing features of independent claims 1, 7, 11, 13, 15 and 22. These claims are allowable for at least the reasons given above. Accordingly, reconsideration and allowance are respectfully requested.

Regarding claims 2-5, 8-10, 12, 14-15, and 17-20, these claims each depend from one of independent claims 1, 7, 11, 13 or 15. In view of the above, it is clear that the combination of Chow, Fuchs and Whitted fails to provide the teachings to establish that claims 1, 7, 11, 13 and 15 are obvious. The dependant claims are, therefore, allowable for at least the reasons shown for claims 1, 7, 11, 13 and 15. Nevertheless, the applicants wish to point out additional reasons why dependent claims 4 and 19 are patentable over the cited art.

Regarding claim 4, this claim recites that “sampling the pixels comprised within the scanlines comprises using a separate shader for each set of scanlines.” The Office Action seems to assert that this feature is disclosed in the Chow et al. reference at Col 10, line 18 and in Figures 6(a) – 6(c), however, it is not. The cited portions of the Chow et al. reference appear to be completely silent with regard to shader operations of any type. Chow et al. merely discloses macroblock matching techniques for video frames, and that these matching techniques may be accomplished by using a series of adder circuits. This in no way discloses the recited features of claim 4. Reconsideration and allowance are respectfully requested.

Regarding claim 19, this claim recites that “the GPU defines an array of coordinate offsets to neighboring pixels, wherein the shader accesses the pixels in the scanlines using the offset array.” The Office Action seems to assert that this feature is disclosed in the Chow et al. reference at Col 6, line 18, however, it is not. Chow et al. at Col 6, lines 18-24 discloses

DOCKET NO.: MSFT-3485/307558.01
Application No.: 10/823,374
Office Action Dated: 12/19/2008

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that scanlines for video arrive at different resolution levels for NTSC or PAL formats and that the pixel data arrives as a stream of scanlines. There is no disclosure of either a shader for accessing and processing the incoming stream of pixels, or that there is any type of offset into the data required to access the scanline pixels, as recited in the claim. Accordingly, reconsideration and allowance are respectfully requested.

CONCLUSION

For all the foregoing reasons, the applicants respectfully submit that the instant application is in condition for allowance.

Date: June 18, 2009

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